

A REVISED CHECKLIST OF THE STONEFLIES (PLECOPTERA) OF WEST VIRGINIA (USA)

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Abstract.—Based on the examination of additional collections and published records, the revised checklist of the stoneflies of West Virginia includes 135 species in 42 genera. Eight state records and 399 county records are added to the plecopteran fauna of the state. We have noted range extensions for the following stoneflies: *Allocapnia illinoensis* Frison; *Perlesta cinctipes* (Banks); *P. frisoni* Banks; and *P. teaysia* Kirchner and Kondratieff.

Key Words: Plecoptera, stoneflies, West Virginia, species checklist, drainage basins

Prior to this review, Tarter and Kirchner (1980) reported 106 species of stoneflies comprising 37 genera from West Virginia. Subsequent emendations and taxonomic changes involving seven of these species, *Allocapnia indianae* Ricker (Stark et al. 1986), *Paracapnia opis* (Newman) (Stark et al. 1986), *Alloperla caudata* Frison (Surdick 2004), *Sweltsa mediana* (Banks) (Surdick 1985), *Acroneuria evoluta* Klapalek (Stark and Brown 1991), *Perlesta placida* (Hagen) (Stark 1989), and *Yugus bulbosus* (Frison) (Nelson 2001) resulted in their deletion from the list. Four other species, *Taeniopteryx nivalis* (Fitch), *Cultus decisus* (Walker), *Yugus arinus* (Frison), and *Alloperla ideii* (Ricker), the latter first reported by Stewart and Stark (1988), are also deleted from the list as we have not been able to confirm their presence with the collection of adult material. However, an additional 25 species have been reported in the published literature. Based on the examination of additional collections, we add eight new state records along with 399 new county records to the plecopteran fauna of West Virginia.

Thus, a total of 135 species representing 42 genera are recorded for the state. Distributions of stoneflies in the seven major drainage basins of West Virginia are presented in this paper as well. Range extensions are noted for the following species: *Allocapnia illinoensis* Frison (IL, IN, MD, ME, MN, NY, OH, ON, QC, VA, WI) southward; *Perlesta cinctipes* (Banks) (AR, IA, IL, OH, KS, MO, NE, OK) eastward; *P. frisoni* Banks (NC, SC, TN, VA) and *P. teaysia* Kirchner and Kondratieff (MD, PA, VA) westward.

Numerous investigators, including Alexander and Stewart (1999), Baumann (1974), Claassen (1931), Farmer and Tarter (1976), Frison (1935, 1942), Griffith and Perry (1992), Griffith et al. (1998), Harper and Kirchner (1978), Hissom and Tarter (1976), Illies (1966), Kirchner (1978, 1982), Kirchner and Kondratieff (1984, 1985, 1988), Kondratieff and Baumann (2000), Kondratieff and Kirchner (1982, 1987, 1988, 1996), Needham and Claassen (1925), Nelson (2001), Ricker (1949, 1952), Ricker and Ross (1968, 1969, 1975), Ross and

Ricker (1964, 1971), Stark (1990), Stark and Gaufin (1976), Stark and Baumann (1978), Stark and Kondratieff (1987, 2004), Stark et al. (1986, 1988), Steele and Tarter (1977), Stewart and Stark (1988, 2002), Stewart et al. (1991), Surdick (1985, 2004), Tarter and Kirchner (1980), Tarter et al. (1975, 1976, 1977), Turner et al. (1996), and Zwick (1973), have reported stonefly records from West Virginia. Janssen (1973) divided the state into seven major drainage basins (Fig. 1). All of the records in this investigation are listed by these seven major drainage basins and counties (Fig. 2) within the drainage basin. Stonefly specimens examined for this study are deposited at the following institutions or agencies: Marshall University (West Virginia Benthological Survey), United States Army Corps of Engineers (Huntington District), Compliance Monitoring Lab (Chapmansville, WV), West Virginia Department of Agriculture, West Virginia Department of Environmental Protection, and West Virginia University. Collecting data (county, stream, date, collector) are recorded in the West Virginia Benthological Survey at Marshall University.

CHECKLIST

Below is a checklist of 135 stonefly species found in West Virginia. For each species in this checklist the drainage basins are indicated by roman numerals (I–VII), counties are enclosed in parenthesis and the contiguous states where they have been reported are enclosed by brackets. New county records are indicated with an “*”, while new state records are denoted by a “****”. We also include an additional 17 species from a group of 58 species found in the immediately adjacent states but not reported from West Virginia (Kondratieff and Baumann 2000). These species, indicated by a “+”, we consider to have a greater likelihood of being collected in the future as they have been recorded from counties in the adjacent states that are contiguous with West Virginia. Additional species and tax-

onomic corrections will likely be incorporated into the West Virginia checklist from ongoing revisionary efforts of S. W. Szczytko on eastern North American Isoperlinae (Perlodidae) and P. P. Harper on eastern North American Leuctridae.

GROUP EUHOLOGNATHA

Family Capniidae

- Allocapnia curiosa* Frison. Drainage basins II, III, IV, V, VII (Braxton, Fayette, Grant, Greenbrier, Hampshire, *Hardy, *McDowell, *Mercer, *Monroe, *Nicholas, Pendleton, Pocahontas, Randolph, *Wayne, *Webster) [MD, PA, VA].
- A. forbesi* Frison. Drainage basin VII (Wayne) [KY, OH].
- A. frisoni* Ross and Ricker. Drainage basins II, V, VI, VII (*Boone, Calhoun, Fayette, Greenbrier, Kanawha, Logan, McDowell, Mingo, *Nicholas, *Pocahontas, Preston, Randolph, Ritchie, Tucker, *Wayne, *Webster) [KY, MD, OH, VA].
- A. frumi* Kirchner. Drainage basins II, V (Fayette, Greenbrier, *Nicholas, Pocahontas, *Upshur, *Webster) [MD].
- A. granulata* (Claassen). Drainage basins I, II, III, V, VI (*Cabell, *Greenbrier, Hampshire, *Hancock, *Hardy, *Kanawha, Logan, Mason, Mineral, *Monroe, Pendleton, Pocahontas, Preston, *Putnam, *Randolph, *Summers, Wood) [KY, MD, OH, PA].
- A. harperi* Kirchner. Drainage basin V (Greenbrier, *Nicholas, Pocahontas) [MD, PA, VA].
- ***A. illinoensis* Frison. Drainage basin I (*Mason, Ohio River, 31 January 2003, 1 ♂, R. F. Kirchner) [MD, PA, VA].
- A. loshada* Ricker. Drainage basins II, V, VII (McDowell, *Monroe, Randolph) [VA].
- A. maria* Hanson. Drainage basins II, III (Hardy, Preston, *Randolph) [MD, PA, VA].
- A. mystica* Frison. Drainage basins I, VI, VII (Cabell, Calhoun, *Mason, Ritchie, *Wayne) [KY, OH, VA].

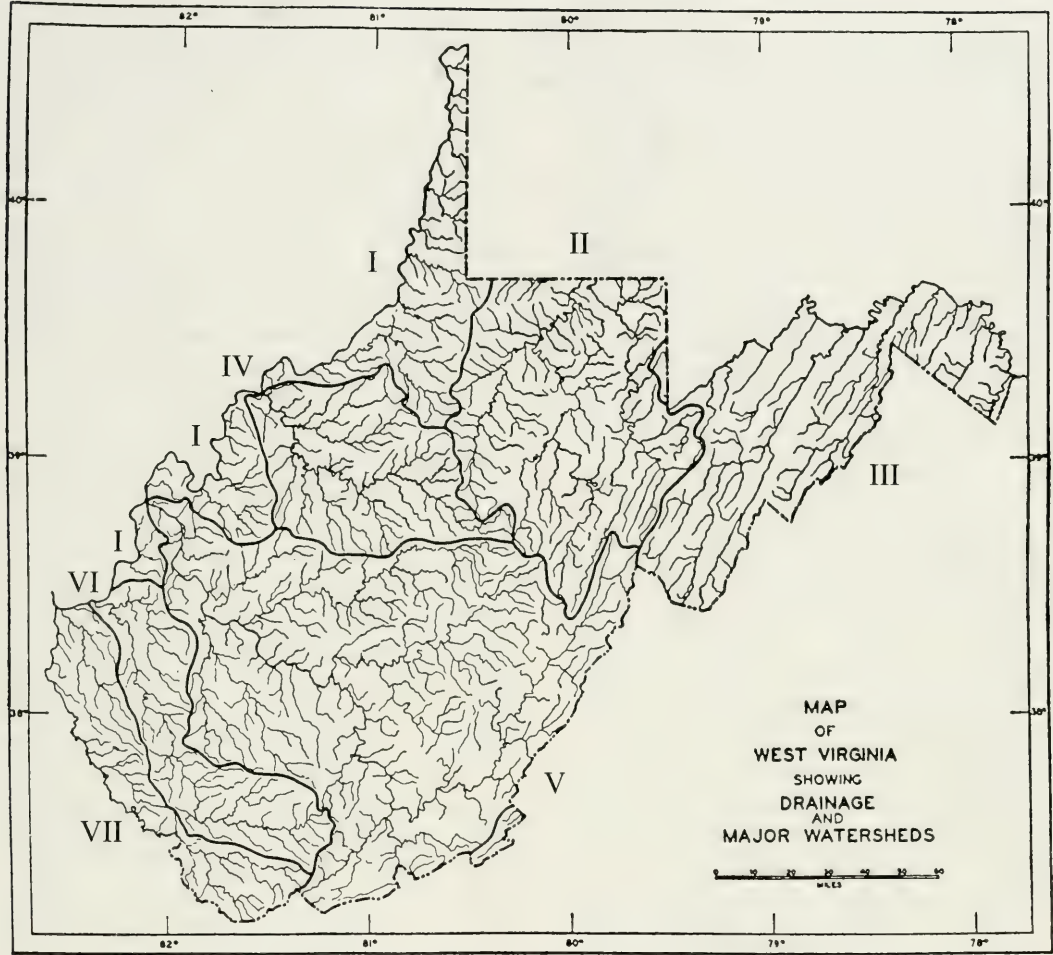


Fig. 1. Drainage basins of West Virginia (according to Janssen 1973). I = Ohio River, II = Monongahela River, III = Potomac River, IV = Little Kanawha River, V = Kanawha River, VI = Guyandot River, VII = Big Sandy River.

- A. nivicola* (Fitch). Drainage basins I–VII (*Boone, *Braxton, *Cabell, Calhoun, Doddridge, Fayette, *Grant, Greenbrier, Hampshire, *Hardy, Lincoln, Logan, *Mason, McDowell, *Mercer, Mineral, Mingo, *Monongalia, *Morgan, Nicholas, Pendleton, Pocahontas, Preston, *Raleigh, Randolph, *Upshur, *Wayne, *Webster) [KY, MD, OH, VA].
- A. ohioensis* Ross and Ricker. Drainage basins VI, VII (Cabell, *Wayne) [KY, OH].
- A. pygmaea* (Burmeister). Drainage basins I–VII (*Braxton, *Cabell, *Greenbrier, *Hampshire, *Hardy, *Kanawha, *Mason, *Mineral, *Monroe, *Morgan, *Pendleton, Pocahontas, *Putnam, *Randolph, *Summers, *Wayne, *Webster) [KY, OH, PA, VA].
- A. recta* (Claassen). Drainage basins I–VII (Braxton, *Cabell, Clay, Grant, *Greenbrier, Hampshire, *Kanawha, Lincoln, Mason, *Mercer, Mineral, Mingo, Monroe, *Nicholas, Pendleton, *Pocahontas, Preston, *Raleigh, Randolph, Roane, Summers, *Wayne, *Webster) [KY, MD, OH, PA, VA].
- A. rickeri* Frison. Drainage basins I–VII (Barbour, *Braxton, Cabell, Calhoun,



Fig. 2. County map of West Virginia.

Doddridge, Gilmer, Greenbrier, *Hampshire, Kanawha, Mason, Mercer, *Mineral, Monroe, Ohio, Pendleton, Preston, Putnam, Pocahontas, *Randolph, Ritchie, Roane, *Summers, Wayne) [KY, MD, OH, PA, VA].

A. vivipara (Claassen). Drainage basins I, II, IV, V, VI, VII (Cabell, Calhoun, Doddridge, *Hancock, Lewis, Ohio, *Mason, McDowell, Preston, Putnam, Ritchie, Roane, *Wayne) [KY, MD, OH, PA, VA].

A. zola Ricker. Drainage basins II, IV, V, VI (*Braxton, Clay, Lincoln, *Mercer, *Nicholas, Pocahontas, Preston, *Raleigh, *Randolph, *Webster) [MD, OH, PA, VA].

Paracapnia angulata Hanson. Drainage ba-

sins II, III, V, VI, VII (Fayette, Grant, Greenbrier, Hampshire, *Hardy, Logan, *Morgan, *Nicholas, *Pendleton, Pocahontas, Randolph, *Summers, Tucker, *Upshur, *Wayne, Webster) [KY, MD, OH, PA, VA].

Family Leuctridae

Subfamily Leuctrinae

Leuctra alexanderi Hanson. Drainage basins II, III, VI (Hardy, Logan, Tucker) [KY, MD, PA, VA].

L. biloba Claassen. Drainage basins II, III (*Hardy, Pendleton, Tucker) [VA].

L. carolinensis Claassen: Drainage basin II (Tucker) [MD, PA, VA].

L. duplicata Claassen. Drainage basins II, III, V (*Greenbrier, Pendleton, Tucker) [MD, PA, VA].

L. ferruginea (Walker). Drainage basins II, III, V, VI, VII (*Hardy, Logan, Mingo, Pendleton, Pocahontas, Preston, Randolph, Tucker, *Wayne) [KY, MD, OH, PA, VA].

L. grandis Banks. Drainage basins II, V (*Greenbrier, Tucker) [MD, PA].

L. maria Hanson. Drainage basins II, VI (Lincoln, Tucker) [PA].

L. rickeri James. Drainage basin VII (*Wayne) [KY, MD, OH, VA].

L. sibleyi Claassen. Drainage basins II, III, V, VI, VII (Cabell, *Greenbrier, *Hardy, Logan, Mingo, *Pocahontas, Tucker) [KY, MD, OH, PA, VA].

L. tenella Provancher. Drainage basin II (Randolph, Tucker) [MD, PA, VA].

L. tenuis (Pictet). Drainage basins III, V, VI (Logan, Mineral, Pocahontas) [KY, MD, OH, PA, VA].

L. triloba Claassen. Drainage basin II (Tucker) [VA].

L. truncata Claassen. Drainage basins II, III, V, VI (Greenbrier, Lincoln, Pendleton, Pocahontas, Tucker, Upshur) [PA, VA].

+ *L. variabilis* Hanson. [MD, PA, VA].

Paraleuctra sara (Claassen). Drainage basins II, III, IV, V, VI, VII (*Braxton, *Greenbrier, *Kanawha, *Hardy, Logan, *McDowell, Mingo, *Morgan, *Pendleton, *Pocahontas, *Randolph, Tucker, *Wayne) [KY, MD, OH, PA, VA].

Zealeuctra claasseni (Frison). Drainage basin IV (Ritchie) [KY].

Z. fraxina Ricker and Ross. Drainage basin III (Hardy) [KY, OH].

Subfamily Megaleuctrinae

Megaleuctra flinti Baumann. Drainage basins II, V (Greenbrier, Pocahontas, Tucker) [MD, PA, VA].

Family Nemouridae

Subfamily Amphinemurinae

Amphinemura delosa (Ricker). Drainage basins I–VII (Berkeley, *Brooke, Cabell,

Grant, *Hancock, Harrison, Lincoln, Mason, Mercer, Mineral, Morgan, Pendleton, Preston, Putnam, Ritchie, Tucker, Tyler, *Upshur, Wayne, Wirt) [KY, MD, OH, PA, VA].

A. nigritta (Provancher). Drainage basins I, II, III, V, VI, VII (Cabell, *Fayette, Hampshire, *Hardy, *Kanawha, *Logan, *Mingo, *Pendleton, Pocahontas, *Randolph, Ritchie, Roane, Tucker, Tyler, *Wayne, *Wirt) [KY, MD, OH, PA, VA].

A. wui (Claassen). Drainage basins II, V (*Fayette, Pocahontas, Randolph, Tucker, Webster) [KY, MD, PA, VA].

Subfamily Nemourinae

Ostrocerca albidipennis (Walker). Drainage basins II, III, V (*Greenbrier, Grant, *Hardy, Pocahontas, *Randolph, Tucker) [MD, PA, VA].

O. complexa (Claassen). Drainage basins II, III, V (*Hardy, Pendleton, Pocahontas, Randolph, Tucker) [MD, PA, VA].

O. prolongata (Claassen). Drainage basins II, III (*Pendleton, Tucker) [PA, VA].

O. truncata (Claassen). Drainage basins II, III, V, VI (Cabell, Greenbrier, *Hardy, Logan, Pendleton, Pocahontas, Tucker) [KY, MD, OH, PA, VA].

Paranemoura perfecta (Walker). Drainage basins II, III, V (*Greenbrier, *Hardy, Pocahontas, Randolph) [MD, PA, VA].

Prostoia completa (Walker). Drainage basins III, IV, V (Braxton, *Hampshire, *Hardy, *Kanawha, *Pendleton, *Pocahontas) [KY, MD, PA, VA].

P. similis (Hagen). Drainage basins II, III, V, VI, VII (Braxton, Grant, *Hampshire, *Kanawha, *Lewis, Logan, *Mineral, Mingo, *Pendleton, Pocahontas, *Putnam, *Wayne) [KY, MD, OH, PA, VA].

Soyedina carolinensis (Claassen). Drainage basins II, IV, V, VI (*Braxton, Logan, *Pocahontas, Randolph) [MD, VA].

+ *S. kondratieffi* Baumann and Grubbs. [MD].

S. vallicularia (Wu). Drainage basins II, III, VI, VII (*Hardy, *Lincoln, Logan, *Mc-

Dowell, Mingo, *Upshur, Wyoming) [KY, MD, OH, PA, VA].

S. washingtoni (Claassen). Drainage basin II (Pendleton, Tucker) [MD, PA].

Family Taeniopterygidae

Subfamily Brachypteryinae

Bolotoperla rossi (Frison). Drainage basins II, IV, V, VII (*Braxton, *Greenbrier, *Lewis, *Nicholas, *Pocahontas, Wayne) [PA, VA].

Oemopteryx contorta (Needham and Claassen). Drainage basins II, V (Greenbrier, *Nicholas, *Pocahontas, Raleigh, Tucker, *Upshur, *Webster) [KY, MD, PA, VA].

O. glacialis (Newport). Drainage basins IV, V (Braxton, *Greenbrier, *Monroe, Pocahontas, *Summers).

Strophopteryx appalachia Ricker and Ross. Drainage basins I, II, III, IV, V, VII (*Braxton, Hampshire, *Kanawha, *Lewis, *Mason, Mercer, Mingo, *Pocahontas, Preston, *Putnam, Tucker, *Wayne, *Webster) [MD, PA, VA].

S. fasciata (Burmeister). Drainage basins I, II, III, IV, V, VII (*Braxton, *Cabell, Jefferson, Hampshire, *Hardy, *Greenbrier, *Kanawha, Mason, *Mineral, Mingo, *Monroe, Nicholas, Pendleton, Pocahontas, *Putnam, *Randolph, *Summers, Wayne, Webster) [KY, MD, OH, PA, VA].

Taenionema atlanticum Ricker and Ross. Drainage basins II, III, IV, V, VI, VII (Braxton, *Cabell, Fayette, Greenbrier, *Hardy, *Kanawha, *Lewis, Logan, Mercer, Mingo, *Nicholas, Pendleton, *Pocahontas, *Putnam, Randolph, Wayne) [KY, MD, OH, PA, VA].

Subfamily Taeniopteryginae

Taeniopteryx burksi Ricker and Ross. Drainage basins I, III, IV, V, VI, VII (Braxton, Cabell, Clay, Fayette, Hampshire, Hardy, Kanawha, Mason, *Mineral, Nicholas, *Putnam, *Summers, Tyler, *Wayne, *Webster) [KY, MD, OH, PA, VA].

***T. lita* Frison. Drainage basin I (*Mason, Ohio River, 31 January, 1995, 1 ♂, R. F. Kirchner) [KY, VA].

T. maura (Pictet). Drainage basins II, III, IV, V, VI, VII (*Braxton, Cabell, Clay, Fayette, Grant, Greenbrier, Hampshire, *Hardy, Mineral, Mingo, *Monroe, Nicholas, Pendleton, Pocahontas, Raleigh, *Randolph, *Summers, Wayne, Webster, Wyoming) [KY, MD, OH, PA, VA].

T. metequi Ricker and Ross. Drainage basins I, II, IV, V, VI, VII (*Braxton, *Cabell, Clay, Greenbrier, Lewis, *Mason, Nicholas, Pocahontas, *Preston, *Wayne, Webster) [KY, MD, OH, PA, VA].

+ *T. nivalis* (Fitch). [MD, PA].

T. parvula (Banks). Drainage basins I, IV, V, VI (*Braxton, *Cabell, Clay, *Greenbrier, Kanawha, Mason, *Monroe, *Nicholas, *Putnam, *Webster) [KY, MD, OH, PA, VA].

T. ugola Ricker and Ross. Drainage basins I, II, IV, V, VII (*Braxton, *Cabell, Greenbrier, Mercer, Mingo, Nicholas, *Pocahontas, Preston, *Raleigh, *Randolph, *Wayne, *Webster, *Upshur) [KY, MD, PA, VA].

Family Chloroperlidae

Subfamily Chloroperlinae

Alloperla aracoma Harper and Kirchner. Drainage basins II, III, IV, V, VI, VII (*Braxton, *Fayette, Logan, Mingo, Pendleton, Tucker) [MD, PA].

+ *A. atlantica* Baumann. [MD, OH, PA, VA].

+ *A. banksi* Frison. [VA].

A. biserrata Nelson and Kondratieff. Drainage basins III, V (Grant, Hardy, Pendleton, Pocahontas) [MD, PA, VA].

A. chloris Frison. Drainage basins II, III, V (*Hardy, Pendleton, Pocahontas, *Randolph) [KY, MD, OH, PA, VA].

A. concolor Ricker. Drainage basin V (*Greenbrier, Nicholas, Pocahontas) [PA].

+ *A. ideii* (Banks). [KY, OH, VA].

A. imbecilla (Say). Drainage basins V, VII

- (Pocahontas, Summers, *Wayne, Webster) [KY, MD, OH, PA, VA].
- A. petasata* Surdick. Drainage basin V (Pocahontas) [OH, PA, VA].
- A. usa* Ricker. Drainage basins II, IV, V, VI, VII (Braxton, *Fayette, *Kanawha, Logan, Mingo, Pocahontas, Randolph, Tucker) [KY, MD, OH, PA, VA].
- Haploperla brevis* (Banks). Drainage basins I–VII (Braxton, *Fayette, *Grant, Hardy, Hampshire, *Jefferson, *Kanawha, Logan, Mason, *Mineral, Mingo, *Morgan, *Nicholas, Pendleton, Pocahontas, Preston, Randolph, *Roane, *Summers, Tucker, *Wayne) [KY, MD, OH, PA, VA].
- Rasvena terna* (Frison). Drainage basin V (*Kanawha, Pocahontas) [PA, VA].
- Suwallia marginata* (Banks). Drainage basins II, III, V (Greenbrier, Pendleton, *Pocahontas, Randolph, Tucker) [MD, PA, VA].
- Sweltsa lateralis* (Banks). Drainage basins II, III, IV, V (Braxton, *Fayette, Greenbrier, Hampshire, Hardy, *Kanawha, Nicholas, Pendleton, Preston, Pocahontas, Randolph, Tucker) [MD, OH, PA, VA].
- S. naica* (Provancher). Drainage basin V (Pocahontas) [PA, VA].
- S. onkos* (Ricker). Drainage basins I–VII (Braxton, Fayette, Greenbrier, Logan, Monongalia, Nicholas, Pendleton, Pocahontas, *Preston, Randolph, Tucker, Wayne, *Wirt) [KY, MD, OH, PA, VA].
- S. palearata* Surdick. Drainage basin III (Hardy, Mineral, Pendleton) [MD, VA].
- S. pocahontas* Kirchner and Kondratieff. Drainage basins IV, V (Braxton, Greenbrier, Pocahontas) [MD].
- Peltoperla arcuata* Needham. Drainage basins II, III, IV, V, VI, VII (Braxton, *Grant, Greenbrier, *Hampshire, *Hardy, Logan, Mingo, *Monongalia, *Nicholas, Pocahontas, Tucker) [MD, OH, PA, VA].
- P. tarteri* Stark and Kondratieff. Drainage basins III, V, VI (Fayette, *Hardy, *Kanawha, Wyoming) [VA].
- + *Tallaperla anna* (Needham and Smith). [VA].
- T. maria* (Needham and Smith). Drainage basins II, III, V (*Grant, Greenbrier, *Jefferson, *Mineral, *Morgan, Nicholas, *Pendleton, *Pocahontas, Raleigh, *Summers, *Tucker, Webster) [MD, PA, VA].

Family Perlidae

Subfamily Acroneurinae

- Acroneuria abnormis* (Newman). Drainage basins I–VII (*Barbour, Berkeley, Boone, Braxton, Fayette, Grant, Greenbrier, Hampshire, *Hardy, Jackson, *Jefferson, Lincoln, Logan, Marion, *Marshall, *Mercer, Mineral, Mingo, Monongalia, Monroe, Morgan, Nicholas, Pendleton, *Pleasants, Pocahontas, Preston, *Putnam, Randolph, *Ritchie, Summers, *Taylor, Tucker, Upshur, Wayne, Webster) [KY, MD, OH, PA, VA].
- A. arenosa* (Pictet). Drainage basin III (Berkeley, *Hardy, *Mineral) [MD, PA, VA].
- + *A. arida* (Hagen). [PA].
- A. carolinensis* (Banks). Drainage basins I–VII (Barbour, *Berkeley, Boone, Braxton, *Brooke, Clay, Fayette, *Grant, Greenbrier, Hampshire, Hancock, *Hardy, Kanawha, Lewis, Logan, *McDowell, Mercer, *Mineral, *Monongalia, Mingo, Morgan, Nicholas, Pendleton, *Pleasants, Pocahontas, Preston, Putnam, *Raleigh, Randolph, Summers, Tucker, *Tyler, Upshur, Wayne, Webster, Wetzell, Wyoming) [KY, MD, OH, PA, VA].
- A. filicis* Frison. Drainage basins II, III, IV, V, VII (Braxton, Greenbrier, *Jefferson, Mingo, Randolph, *Ritchie, *Summers) [KY, MD, OH, PA, VA].

Subfamily Paraperlinae

- Utaperla gaspesiana* Harper and Roy. Drainage basin V (Pocahontas) [PA].

GROUP SYSTELLOGNATHA

Family Peltoperlidae

Subfamily Peltoperlinae

- A. frisoni* Stark and Brown. Drainage basins I, II, III, IV, V (*Gilmer, *Greenbrier, *Hardy, *Jackson, *Mason, *Monongalia, *Nicholas, Pocahontas, *Putnam, *Randolph, *Ritchie, Summers, *Tyler) [KY, MD, OH, PA, VA].
- A. internata* (Walker). Drainage basins II, III, IV, V (*Barbour, Berkeley, Braxton, Clay, *Gilmer, Greenbrier, *Hardy, Mercer, Mineral, Monongalia, Morgan, Pocahontas, Preston, Randolph, *Summers, Webster) [KY, VA].
- A. kirchneri* Stark and Kondratieff. Drainage basins II, V, VI (Cabell, Nicholas, Preston) [KY, VA].
- +*A. kosztarabi* Kondratieff and Kirchner. [VA].
- A. lycorias* (Newman). Drainage basins I–VII (Barbour, Berkeley, Boone, Braxton, Greenbrier, Grant, Lewis, Lincoln, Monongalia, Monroe, *Nicholas, *Pendleton, *Pleasants, Pocahontas, Preston, Randolph, Ritchie, Roane, Summers, Tucker, Wayne, Webster, Wood, Wyoming) [KY, MD, OH, PA, VA].
- A. perplexa* Frison. Drainage basins I, II, IV, V, VI, VII (Barbour, Doddridge, Gilmer, Greenbrier, *Jackson, Lincoln, Marion, Mason, Mingo, Monongalia, *Nicholas, *Pleasants, Pocahontas, *Summers, *Tyler, Upshur, Wayne, Wirt, *Wood) [KY, OH, PA].
- +*Attaneuria ruralis* (Hagen). [MD, OH, PA, VA]
- Eccoctura xanthenes* (Newman). Drainage basins I–VII (*Barbour, Berkeley, *Greenbrier, *Hardy, Jackson, Lincoln, Logan, Mingo, Monongalia, Nicholas, Pocahontas, *Raleigh, Ritchie, Roane, *Summers, Wayne) [KY, MD, OH, PA, VA].
- Hansonoperla appalachia* Nelson. Drainage basin V (Greenbrier, Nicholas) [MD, PA, VA].
- H. hokolesqua* Kondratieff and Kirchner. Drainage basin VII (Wayne) [KY].
- ***Perlesta cinctipes* (Banks). Drainage basin II (*Monongalia, no locality data, 1 ♂, 6 ♀, L. Butler) [OH].
- P. decipiens* (Walsh). Drainage basins I–VII (Braxton, *Cabell, Clay, Greenbrier, Jackson, Jefferson, Hampshire, *Mason, *Mineral, Monongalia, Pendleton, Pleasants, Pocahontas, Preston, Putnam, Randolph, *Ritchie, Tyler, Wayne, Wirt) [KY, OH, PA, VA]
- ***P. frisoni* Banks. Drainage basin III (*Pendleton, Big Run of North Fork of South Branch of Potomac River, 29 July 1978, 1 ♂, R. F. Kirchner) [VA].
- ***P. nelsoni* Stark. Drainage basin V (*Pocahontas, Tea Creek of Williams River, 6 August 1977, 1 ♂, R. F. Kirchner) [MD, VA].
- ***P. teaysia* Kirchner and Kondratieff. Drainage basins I, II, V (*Kanawha, no locality data, 17 June 1988, 1 ♂, 1 ♀, D. C. Tarter; *Mason, Ohio River, 18 June 1998, 1 ♂, 1 ♀, R. F. Kirchner; *Randolph, Shavers Fork, 19 September 1980, 1 ♂, D. C. Tarter) [MD, PA, VA].
- Perlinella drymo* (Newman). Drainage basins I, II, III, V (Cabell, Hampshire, *Mason, Putnam, Tucker) [KY, MD, OH, PA, VA].
- P. ephyre* (Newman). Drainage basins III, V (*Fayette, Hampshire) [KY, MD, OH, PA, VA].

Subfamily Perlinae

- ***Agnetina annulipes* (Hagen). Drainage basins III, V, (*Fayette, New River, 10 June 1978, 1 ♂, L. K. Evans, *Hampshire, Cacapon River of Potomac River, 16 July 1980, 2 ♀, B. C. Kondratieff, *Summers, New River 10 July 1978, 1 ♂, R. F. Kirchner, Bluestone River, 22 June 1977, 1 ♂ 1 ♀, R. F. Kirchner, Bluestone River, 21 June 1980, 1 ♂ 1 ♀, R. F. Kirchner) [MD, VA, PA].
- A. capitata* (Pictet). Drainage basins II, III, IV, V, (Braxton, Clay, Grant, Greenbrier, Hardy, Mercer, Monroe, Nicholas, Pocahontas, Randolph, Summers) [KY, MD, OH, PA, VA].
- ***A. flavescens* (Walsh). Drainage basin III (*Berkeley, Sleepy Creek, 24 July 1975, 2 ♀, L. Miller, *Hampshire, Romney, 15

June 1976, 1 ♀, L. Miller, *Hardy, no locality data, 19 July 1975, 1 ♀, L. Miller, *Mineral, Burlington, 10 July 1979, 2 ♀, L. Miller) [KY, MD, OH, PA, VA].
Neoperla choctaw Stark and Baumann. Drainage basin III (Berkeley) [PA].
N. clymene (Newman). Drainage basins III, V (*Hampshire, Summers) [VA, PA].
 + *N. robisoni* Poulton and Stewart. [MD, PA].
N. stewarti Stark and Baumann. Drainage basin III (Berkeley, Hampshire) [KY, MD, OH, PA, VA].
Paragnetina immarginata (Say). Drainage basins I, II, III, IV, V (*Braxton, Clay, *Grant, *Greenbrier, Hardy, Mineral, Nicholas, Pendleton, *Pleasants, Pocahontas, Preston, Randolph, Tucker, Webster) [KY, MD, PA, VA].
P. media (Walker). Drainage basins II, III, IV, V, VII (Braxton, Clay, *Fayette, *Greenbrier, Lewis, Mercer, Mingo, *Monongalia, Monroe, Nicholas, Pendleton, Pocahontas, Preston, Randolph, Summers, Tucker, Upshur, Wayne, Webster) [KY, MD, OH, PA, VA].

Family Perlodidae

Subfamily Isoperlinae

Clioperla clio (Newman). Drainage basins I, II, III, V, VI, VII (Cabell, *Hardy, Jackson, Logan, Mason, McDowell, Mercer, Mingo, Monongalia, Nicholas, Pendleton, Pocahontas, Putnam, Raleigh, Randolph, Summers, *Tucker, Wayne, Webster) [KY, MD, OH, PA, VA].
Isoperla bilineata (Say). Drainage basins I, II, VI (*Cabell, Jackson, Lewis, Mason, Monongalia, Pocahontas, Ritchie) [KY, OH, PA, VA].
I. burksi Frison. Drainage basins I, VII (Jackson, Mason, *Wayne) [KY, MD, OH, VA].
I. cotta Ricker. Drainage basins III, VII (Mingo, Pendleton, Pocahontas).
I. dicala Frison. Drainage basins II, V (*Kanawha, Randolph, Summers) [MD, PA, VA].

I. gibbsae Harper. Drainage basin VII (Wayne) [MD].
I. holochlora (Klapalek). Drainage basins I–VII (Hardy, Jackson, Logan, McDowell, Mingo, Pocahontas, Randolph, Ritchie, Summers, Webster) [KY, MD, PA, VA].
I. lata Frison. Drainage basins II, III, IV, V (*Braxton, Greenbrier, Nicholas, Pendleton, Pocahontas, Randolph, Webster) [PA, VA].
 + *I. major* Nelson and Kondratieff. [VA].
I. marlynia Needham and Claassen. Drainage basin V (Mercer) [KY, PA, VA].
 + *I. montana* (Banks). [PA].
I. namata Frison. Drainage basins I–VII (*Braxton, Calhoun, Gilmer, Harrison, Jackson, Lewis, Logan, Mercer, Mingo, Monroe, Nicholas, Pendleton, Pocahontas, Putnam, Randolph, Summers, Webster) [KY, MD, OH, PA, VA].
I. orata Frison. Drainage basins I, II, III, V (*Braxton, *Hampshire, Jackson, Monongalia, Pocahontas, Randolph, Ritchie, Tucker) [OH, PA, VA].
I. richardsoni Frison. Drainage basins V, VII (Mingo, Pocahontas) [KY, PA].
I. signata (Banks). Drainage basin V (*Summers) [OH, PA, VA].
I. similis (Hagen). Drainage basins II, III, IV, V, VI, VII (Greenbrier, *Hardy, Lincoln, McDowell, Monongalia, Morgan, Nicholas, Pendleton, *Pocahontas, Randolph, Tucker, Webster, Wood) [KY, MD, PA, VA].
I. slossonae (Banks). Drainage basin II (Tucker) [PA, VA].
I. transmarina Newman. Drainage basins I, II, IV, V, VI, VII (Cabell, Calhoun, *Fayette, Gilmer, Jackson, Lewis, Marion, Mason, McDowell, Mercer, Monongalia, Monroe, Nicholas, *Pocahontas, Preston, Putnam, Randolph, Ritchie, Summers, Webster, *Wood) [KY, PA, VA].

Subfamily Perlodinae

+ *Cultus decisis decisis* (Walker). [PA].
C. verticalis (Banks). Drainage basins II, V

- (Harrison, Kanawha, Nicholas, Pocahontas, Randolph, Webster) [PA, VA].
- Diploperla duplicata* (Banks). Drainage basins I, II, IV, V, VI, VII (*Braxton, Cabell, Fayette, Greenbrier, Jackson, Kanawha, Lewis, Mason, Monongalia, Monroe, *Nicholas, *Pocahontas, Putnam, Randolph, Ritchie, *Upshur, Wayne) [MD, PA, VA].
- D. kanawholensis* Kirchner and Kondratieff. Drainage basins II, IV, V (Braxton, Lewis, *Mercer, *Nicholas, Pocahontas) [VA].
- + *D. morgani* Kondratieff and Voshell. [VA].
- D. robusta* Stark and Gaufin. Drainage basins I, II, IV, V, VI, VII (*Braxton, Cabell, Calhoun, Fayette, Greenbrier, Jackson, Kanawha, Lewis, Lincoln, Logan, Mason, Mingo, Monongalia, Monroe, Nicholas, Pleasants, *Pocahontas, Putnam, *Raleigh, Randolph, *Upshur, Wayne, Webster, Wirt) [KY, MD, OH, PA, VA].
- Helopicus subvarians* (Banks). Drainage basins II, IV, V, VI (*Braxton, *Cabell, *Kanawha, *Lewis, *Mercer, Nicholas, *Putnam, Randolph, Summers) [KY, PA, VA].
- Isogenoides hansonii* (Ricker). Drainage basins II, III, IV, V (*Braxton, Greenbrier, *Lewis, Nicholas, *Pendleton, Randolph, Tucker, Webster) [MD, PA, VA].
- Malirekus hastatus* (Banks). Drainage basins II, III, IV, V, VI, VII (Braxton, Clay, Fayette, Greenbrier, Kanawha, Logan, McDowell, Mercer, *Mineral, Mingo, Nicholas, Pendleton, Pocahontas, Preston, *Raleigh, Randolph, *Summers, Tucker, *Upshur, Webster) [KY, VA].
- + *Malirekus iroquois* Stark and Szczytko. [MD, PA].
- Remenus bilobatus* (Needham and Claassen). Drainage basins II, III, V, VII (*Berkeley, *Hardy, *Kanawha, Mingo, *Morgan, Tucker, *Wayne, Webster) [KY, MD, OH, PA, VA].
- + *Yugus arinus* (Frison). [VA].
- Y. kirchneri* Nelson. Drainage basins II, III, IV, V, VI, VII (*Braxton, Calhoun, *Fayette, Greenbrier, *Hardy, Kanawha, Logan, Mingo, Nicholas, *Pendleton, Pocahontas, *Randolph, Tucker, *Wayne, Webster) [MD, PA, VA].

Family Pteronarcyidae

- Pteronarcys biloba* Newman. Drainage basins II, III, IV, V (Braxton, Clay, Greenbrier, Hardy, Mineral, Monongalia, *Monroe, Nicholas, Pendleton, Pocahontas, Preston, Randolph, Tucker, Webster) [KY, MD, OH, PA, VA].
- P. comstocki* Smith. Drainage Basins II, III, IV, V (*Braxton, Grant, *Greenbrier, *Lewis, Mineral, Monongalia, Nicholas, Pendleton, Pocahontas, Randolph, Webster) [KY, PA, VA].
- P. dorsata* (Say). Drainage Basins III, V (Clay, Hampshire, Jefferson, *Pocahontas, *Putnam) [KY, MD, OH, PA, VA].
- P. proteus* Newman. Drainage Basins II, III, IV, V, VI, VII (Boone, Braxton, Clay, Fayette, *Grant, Greenbrier, *Hampshire, Hardy, *Jefferson, Kanawha, Lewis, *Logan, *Mineral, Mingo, Monongalia, *Morgan, *Monroe, Nicholas, Pendleton, Pocahontas, Preston, *Raleigh, Randolph, Summers, Tucker, *Upshur, Webster) [KY, MD, OH, PA, VA].

DISCUSSION

Presence/absence of the stonefly species for the seven drainage basins was analyzed using a computerized unweighted pair-group arithmetic average clustering of the mean character difference (Swofford 2002). The results (Fig. 3) indicate two large clusters one consisting of drainage basins II, III, and V and the other composed of I, IV, VI, and VII. This, in part, may reflect the larger number of species exhibited by drainage basins belonging to the former cluster. It also may reflect habitat differences between an ordered trellised drainage system that characterizes drainage basin III, the eastern half of drainage basin II, as well as the extreme eastern edge of drainage basin V, and the haphazard drainage system that char-

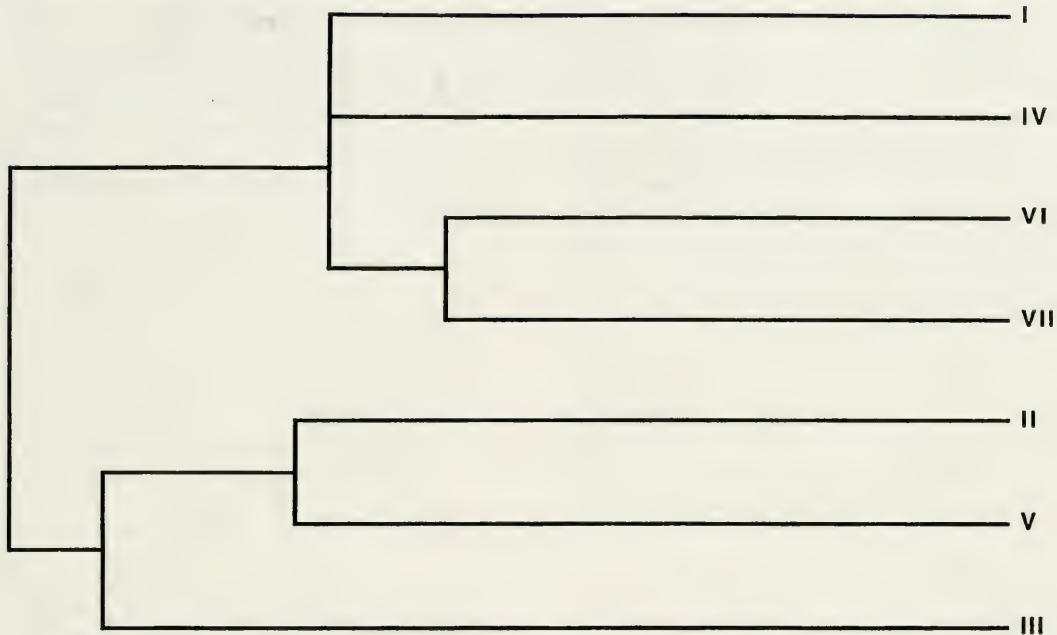


Fig. 3. Dendrogram resulting from computerized unweighted pair-group arithmetic average clustering of the mean character difference of presence/absence data of Plecoptera species from the seven drainage basins in West Virginia. I = Ohio River, II = Monogahela River, III = Potomac River, IV = Little Kanawha River, V = Kanawha River, VI = Guyandot River, VII = Big Sandy River.

acterizes drainage basins I, IV, VI, VII, the western half of drainage basin II, and much of drainage basin V (Jansson 1973).

The following 15 stonefly species were found in all drainage basins (I–VII) of West Virginia: *Acroneuria abnormis*, *A. carolinensis*, *A. lycorias*, *Allocapnia nivicola*, *A. pygmaea*, *A. recta*, *A. rickeri*, *Amphinemoura delosa*, *Amphinemura nigrutta*, *Ectopectura xanthenes*, *Haploperla brevis*, *Isopterla holochlora*, *I. namata*, *Perlesta decipiens*, and *Sweltsa onkos*. The highest percentage (76.3) of the stonefly species was found in drainage basin V, while the lowest percentage (28.1) was noted in drainage basin I (industrialization and farming). The distribution pattern (drainage basins II, III, IV, V, VI, VII) of *Isopterla similis*, *Paraleuctra sara*, *Malirekus hastatus*, *Paragnetina media*, *Pteronarcys proteus*, *Taenionema atlanticum*, *Taeniopteryx maura* and *Yugus kirchneri* appears to indicate sensitivity to industrial pollution but greater tolerance to acid mine pollution. The distri-

bution of *Clioperla clio* displays a pattern closely related with the areas of Pennsylvania sandstone found in the state. Ten of the 135 stonefly species in West Virginia were restricted to drainage basin V, while seven species were restricted to drainage basins III and six were restricted to drainage basin II. Four or fewer stonefly species were restricted to drainage basins I, IV, VI, and VII. Collected from 37 counties, the perlid *Acroneuria carolinensis* was the most widely distributed stonefly species in the state. All 55 counties of West Virginia recorded stonefly representatives.

ACKNOWLEDGMENTS

We are indebted to the following individuals who loaned specimens or helped with identifications and records: J. Bailey, Wildlife Biologist II, West Virginia Department of Environmental Protection; L. Butler, West Virginia University; J. L. Earle, Pennsylvania Department of Environmental Protection; S. A. Grubbs, Western Kentucky

University; R. W. Hood, US Geological Survey, Denver; R. F. Kirchner, US Army Corps of Engineers, Huntington District; B. C. Kondratieff, Colorado State University; L. Miller, West Virginia Department of Agriculture; D. R. Smith, Systematic Entomology Laboratory, USDA, Washington, D.C.; and C. White, Compliance Monitoring Lab. We appreciate the suggestions from the pre-publication reviews of the manuscript from D. Chaffee, Forest Biologist Consultant, Richmond, KY, R. F. Kirchner, US Army Corps of Engineers, Huntington District, and M. S. Schorr and G. S. Van Horn, Department of Biological and Environmental Sciences, the University of Tennessee at Chattanooga. We also acknowledge the helpful comments of an anonymous reviewer. Special thanks to M. Shafer for typing the paper.

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